

CLAIMS

1. An apparatus comprising:  
means for receiving an  $(x,y)$  coordinate of a modulated  
signal;  
means for determining a first value according to the  
5 equation  $-2x(\hat{I}_i - \hat{I}_j)$ , wherein  $\hat{I}_i$  is the I component of  
a first symbol closest to the  $(x,y)$  coordinate and  
 $\hat{I}_j$  is the I component of a second symbol closest  
to the  $(x,y)$  coordinate with a bit value opposite  
of the corresponding bit value of the first  
10 symbol;  
means for determining a second value according to the  
equation  $2y(\hat{Q}_i - \hat{Q}_j)$ , wherein  $\hat{Q}_i$  is the Q component of  
the first symbol and  $\hat{Q}_j$  is the Q component of the  
second symbol;  
15 means for determining a third value equivalent to the  
sum of  $A_0(\hat{I}_i^2 + \hat{Q}_i^2)$  and  $-A_0(\hat{I}_j^2 + \hat{Q}_j^2)$ , wherein  $A_0$  is the  
minimum amplitude;  
means for determining a log-likelihood ratio (LLR) as a  
sum of the first value, the second value, and the  
20 third value; and  
means for transmitting the LLR to a decoder.
2. The apparatus of Claim 1, further comprising means  
for storing the value of at least one of  $2(|\hat{I}_i - \hat{I}_j|)$ ,  $2(|\hat{Q}_i - \hat{Q}_j|)$ ,  
 $A_0(\hat{I}_i^2 + \hat{Q}_i^2)$ ,  $-A_0(\hat{I}_j^2 + \hat{Q}_j^2)$ , the sign of  $2x(\hat{I}_i - \hat{I}_j)$ , and the sign of  
25  $2y(\hat{Q}_i - \hat{Q}_j)$  is stored in memory.

3. The apparatus of Claim 1, wherein the means for determining the first value comprises an adder and a sign inverter connected to the adder.

4. The apparatus of Claim 1, wherein the means for  
5 determining the second value comprises an adder and a sign inverter connected to the adder.

5. An method for determining the log-likelihood ratio, the method comprising the steps of:

receiving an (x,y) coordinate of a received signal;

10 determining a first value according to the equation

$-2x(\hat{I}_i - \hat{I}_j)$ , wherein  $\hat{I}_i$  is the I component of a first symbol closest to the (x,y) coordinate and  $\hat{I}_j$  is the I component of a second symbol closest to the (x,y) coordinate with a bit value opposite of the

15 corresponding bit value of the first symbol;

determining a second value according to the equation

$2y(\hat{Q}_i - \hat{Q}_j)$ , wherein  $\hat{Q}_i$  is the Q component of the first symbol and  $\hat{Q}_j$  is the Q component of the second symbol;

20 determining a third value equivalent to the sum of  $A_0(\hat{I}_i^2 + \hat{Q}_i^2)$  and  $-A_0(\hat{I}_j^2 + \hat{Q}_j^2)$ , wherein  $A_0$  is the minimum amplitude; and

determining a log-likelihood ratio as the sum of the first value, the second value, and the third  
25 value.